2634

Serial No.	09/846,410	15 Feb.05
Filing date	02/13/2001	
Name	Urbain A. von der Embse	
Unit	2634	
Examiner	Jason M. Perilla	

DETAILED ACTION RESPONSE

Attached are the original copy witb the crossed out deleted text and the new text underlined, and a clean copy.

Attached are the transmittal form PTO/SB/21, request for extension of time PTO/SB/22 and my payment check, and the change of address PTO/SB/122.

The name "complex Walsh" codes is changed to "Hybrid Walsh", and the "Hybrid complex Walsh" to "generalized Hybrid Walsh" to help clarify the distinction between previous complex Walsh work and the patent disclosure of the Hybrid Walsh codes which are complex Walsh codes that are in 1-to-1 correspondence with the discrete Fourier transform (DFT) codes, and to better describe the "generalized Hybrid Walsh" which is a combination of the Hybrid Walsh and other orthogonal and quasi-orthogonal codes using tensor product, direct sum, and functional combining.

1. I have deleted claims 1-4 and added the new claims 5-6

2. In response to your recommendations, I have reorganized and re-edited the patent application and have added information in the specification to support the claims 5-6 and added information in the description of related art to provide the understanding of current art relevant to this patent.

3. References include your required list and are submitted in a separate paper as per the USPTO recommended organization for a patent filing.

4. The abstract is rewritten to address your recommendations and the specification is reorganized and edited and content added to meet the USPTO guidelines.

5.-14. New claims 5-6 are written to address your issues and information has been added in the invention disclosure to support these claims and prior art information has been added to allow the examiner to understand the innovations offered by this invention compared to the prior art. In the specification I have corrected errors and organization and have added a cellular network application including the fast encoder and decoder algorithms and implementations as supporting figures to the existing 6 figures.

In section "II. Description of Related Art" I have added information that describes CDMA encoding and decoding for cellular networks, the current orthogonal variable spreading factor (OVSF) applications of real Walsh codes for simultaneous transmission of multiple data rate CDMA users, a history of complex Walsh codes developed in the early 70's, impact of patents by Yang and Honkasalo, work on combining real Walsh codes with PN (pseudo noise) codes which predated the development of CDMA, drawings of a representative cellular network application with implementation of the transmitter (Tx) CDMA encoding with real Walsh and the receiver (Rx) CDMA decoding with real Walsh, and equations plus drawings depicting OVSF real Walsh Tx encoding and Rx decoding of multiple data rate users.

15. As is clear in this documentation, only real Walsh channelization codes have been used for CDMA. The complex Walsh codes developed in the early 70's were developments that did not

find applications because of complexity and because of no performance improvements compared to the real Walsh. Hybrid Walsh codes of this invention are in 1-to-1 correspondence with the DFT (discrete Fourier transform) codes, are simple to generate and use, and have been demonstrated to improve communications performance compared to the real Walsh.

Fast and computationally efficient encoding and decoding algorithms are defined in the patent specification. For Hybrid Walsh in lines 6-15 on page 46 fast encoder and decoder algorithms are computationally efficient algorithms since the number of arithmetic add and multiply operations per data symbol are linear in M where N=2^M for a NxN Hybrid Walsh code matrix and which is considerably more efficient than the linear dependency on N for direct calculation algorithms. For generalized Hybrid Walsh lines 15-28 on page 51 fast encoder and decoder algorithms are computationally efficient algorithms since their arithmetic add and multiply operations per data symbol are linear in the $\{M_n\}$ where $N_n=2^{\wedge}M_n$ is the size of one of the code matrices indexed on "n" in the construction of the generalized Hybrid Walsh code matrix and which is considerably more efficient than the linear dependency on $N=N_0. . .N_n. . .$ for direct calculation algorithms, and where the component code matrices are $N_0xN_0, N_1xN_1, . . .$ and the generalized Hybrid Walsh code matrix is NxN.

Yang (US 6,674,712) combines real Walsh codes with the quaternary complex-valued Kerdock codes to generate a set of quasi-orthogonal CDMA codes using the complex multiply operation **126** in FIG. **1C** to combine the real Walsh codes **120, 121** with the complex Kerdock codes upon replacing the complex short PN codes **124, 125** with the Kerdock codes, adding a zero to the Kerdock codes of length (2^K-1) to make them 2^M chip codes and using real Walsh 2^M chip codes, to allow the phase addition of these codes in the complex multiply **126**. Prior art represented by the

paper by Hannon et. al. (IEEE Trans. Inform. Theory, vol. 40, pp. 301-319, 1994) and other prior publications derived the Kerdock codes with the permutation and construction algorithm in this patent. Unlike Yang, current CDMA art uses the same 2^M PN code for all real Walsh channelization codes which keeps the orthogonality property while providing the desired low correlation sidelobe properties.

The patent specification defines a method for mapping the multiple data rate symbols onto the input data vector for the Hybrid Walsh and generalized Hybrid Walsh encoding which enables the use of common block codes for these users and which allows the implementation of the defined fast encoder and fast decoder algorithms and isolation of the user groups for improved performance. Current OVSF Walsh codes do not have fast algorithms and are not computationally efficient and have no isolation of user groups for multiple data rate users and are described in the "II. Description of related art" for reference.

Honkasalo (US-6,317,413) develops a method to assign Walsh codes to variable data rate users for CDMA communications which is an application of the current OVSF in equations **(1)**,**(2)** and in FIG. **2B** to the cellular network example in FIG. **1B** for the link **106** between the mobile user **105** and base station **107**. In the example Tx implementation for the fundamental and supplementary users, there are N_4=2^4=16 channels available at the highest data rate R supported by the communications link. Each channel is encoded with a 1x16 chip Walsh code selected from the 16x16 Walsh code matrix W_4. To support R and lower data rates R/2,R/4,R/8,R/16 and allow several users to occupy each channel, the user code lengths are extended to 1xN_5, 1xN_6, 1xN_7, 1xN_8=2^8=256 chips respectively as shown in equations **(1)**. From equations **(1)**,**(2)** the code index c for the lowest data rate can be written as the binary word $c=c_0c_1c_2c_3c_4c_5c_6c_7$ where the $c_1,\dots,c_8$ are the binary coefficients. The first 4 bits $c_0c_1c_2c_3$ are the W_4

code for users at rate R, the first 5 bits $c_0c_1c_2c_3c_4$ are the W_5 code index for users at data rate R/2, . . ., and the 8 bit word $c_0c_1c_2c_3c_4c_5c_6c_7$ is the W_8 code index for the lowest data rate R/16. This enables the code assignments to be specified by the 4 bit subfield $c_0c_1c_2c_3$ of c for the 16 channels and the last 4 bits $c_4c_5c_6c_7$ for the lower user data rates. Knowing the channel assignment this allows the users within a channel to be specified by the last 4 bits.

Thanks ever for your welcomed help and guidance with this patent application.

Contact No. 310.641.0488

Address Urbain A. von der Embse
7323 W. 85th St.
Westchester, CA 90045-2444

Signature Urbain A. von der Embse

Name Urbain A. von der Embse